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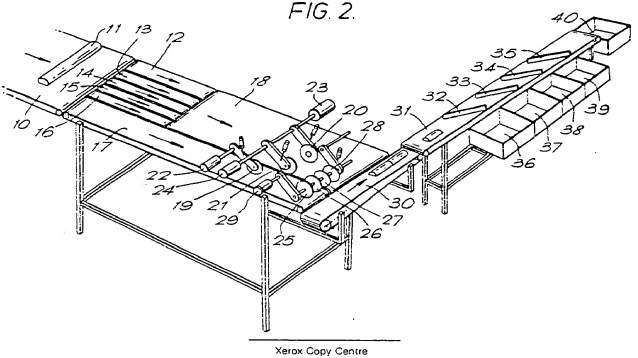
(54) Apparatus for grading meat or fish.

(57) An apparatus for the automatic cutting of meat or fish material to produce portions of a predetermined weight and length, comprising at least two adjacent parallel conveyors (12-17) suitable for transporting a meat or fish material lying partly on each conveyor (12-17), at least two adjacent parallel weighing machines, a computer (not shown) and a fixed or movable cutting device (17-21, 25-28) positioned downstream of the weighing machines. The computer is preprogrammed for at least one product factor defining a specified weight for a specified length, each weighing machine being adapted to weight the material lying on the load-bearing platform and to feed the recorded weight to the computer which is adapted to calculate a weight factor defining a specified weight for a specified length of material, the cutting device (19-21, 25-28) when movable being adapted to move transversely to the direction of movement of the conveyors, and when fixed there being provided means (18), positioned between the weighing machines and the cutting device, for causing the material to move transversely relative to the longitudinal direction of movement, the cutting device (19-21, 25-28) being adapted to cut the material parallel to the longitudinal direction of movement of the conveyors (12-17).

FIG. 2.



EP 0 288 592 A1

Apparatus for grading meat or fish

The present invention relates to an apparatus and a process for the automatic cutting of meat or fish to produce portions of a predetermined weight and length.

In the production of packaged frozen meat or fish products, it is important that the weight of the portions is controlled as accurately as possible, otherwise the weights will vary at the time of filling the packages resulting in certain disadvantages : underweight portions of incorrect weight have to be rejected leading to significant losses of fish or meat material while overweight portions have to be adjusted to the correct weight, which increases the costs.

The most reliable way of ensuring a constant weight is by cutting and weighing the portions manually. However, this is labour intensive and very time-consuming. Mechanical means for automatic and semi-automatic cutting and weighing of portions have been described but these generally involve the use of very complex machinery. For example, the use of photoelectric sensors has been proposed to detect the linear measurements of fish but since not only the length, but also the breadth and thickness very appreciably, this method would not lead to the cutting of portions with an accurate constant weight.

In our co-pending European Patent Application No. 86102704.3 we have described and claimed an apparatus and process for the automatic cutting of meat or fish material to produce portions of a predetermined constant weight, comprising a pair of adjacent parallel conveyors suitable for transporting a meat or fish material lying partly on each conveyor, a weighing machine and a movable cutting device characterised in that the parallel conveyors are adapted to travel in the same direction at substantially the same speed and that at least part of one of the parallel conveyors is adapted to form the load-bearing platform of the weighing machine, the weighing machine being adapted to weigh the material on the load-bearing platform and the cutting device being adapted to move transversely relative to the direction of movement of the conveyors, the direction and distance of the transverse movement being controlled by the weight recorded on the weighing machine, and then to cut the material parallel to the direction of movement.

We have now developed an improvement to this apparatus and method which, surprisingly, enables fish and meat pieces having widely varying thicknesses to be cut automatically to a predetermined constant weight and length and which may be graded in size groups.

Accordingly the present invention provides an apparatus for the automatic cutting of meat or fish material to produce portions of a predetermined weight and length, comprising at least two adjacent parallel conveyors suitable for transporting a meat or fish material lying partly on each conveyor, at least two adjacent parallel weighing machines, a computer and a fixed or movable cutting device positioned downstream of the weighing machines characterised in that the computer is preprogrammed for at least one product factor defining a specified weight for a specified length, the parallel conveyors are adapted to travel in the same direction at substantially the same speed and that at least part of each of the parallel conveyors is adapted to form the load-bearing platform of one of the weighing machines, each weighing machine being adapted to weigh the material lying on the load-bearing platform and to feed the recorded weight to the computer which is adapted to calculate a weight factor defining a specified weight for a specified length of material, the cutting device when movable being adapted to move transversely to the direction of movement of the conveyors, and when fixed there being provided means, positioned between the weighing machines and the cutting device, for causing the material to move transversely relative to the longitudinal direction of movement, the direction and distance of the transverse movement of the cutting device or the means for causing the material to move transversely being controlled by a comparison of the actual weight factors calculated with the preprogrammed product factors, the cutting device being adapted to cut the material parallel to the longitudinal direction of movement of the conveyors.

The weight factors depend on the width, thickness and density of the meat or fish material lying on a particular weighing machine.

The parallel conveyors conveniently comprise endless belts. The parallel conveyors conveniently comprise a plurality of endless belts each of which is conveniently fixed to a respective weighing machine via the axles of the rollers.

The adjacent parallel conveyors are preferably separated by a short distance so that there is a gap between them. The presence of this gap helps to eliminate the weight influence caused by any vertical or horizontal change of distance, or any speed difference between the two conveyors. The product has a natural elasticity and the elastic zone of the product in the gap between the conveyors helps to eliminate this weight influence.

Generally, the width of the gap is as small as possible and may conveniently be from about 5 to 20 mm

and preferably from 7.5 to 15 mm. The weighing machines are conveniently of the type consisting of continuously working scales based on load cells, or they may be spring balances. We have found, surprisingly, that the weighing machines give a reliable reading of the weight of that part of the meat or fish material on the load-bearing platform. Since the widths of the load-bearing platforms and the width of the gaps are known, the weight recorded by each weighing machine can be used to calculate the weight factors by the computer which compares the weight factors with the preprogrammed product factor and actuates the cutting device or the means for causing the meat or fish material to move transversely so that either the cutting device or the meat or fish material travels an appropriate distance in the direction required so that the desired weight and length may be cut by the cutting device. It should be understood that the preprogrammed product factor is a range of weights and lengths conveniently spanning up to 10% on either side of the desired weight and length. Preferably the computer is preprogrammed for more than one product factor, thus enabling portions of different weight and length specifications to be obtained at the same time.

The major advantage in having at least two parallel weighing machines is that immediate information can be obtained about the weight distribution along the meat or fish pieces and by means of a computer it will be possible to select the optimal cutting pattern for each piece of product at a very high speed. The number of parallel weighing machines may conveniently be from 3 to 10, preferably from 4 to 6. If desired, a second set of adjacent parallel conveyors adapted to form the load-bearing platforms of weighing machines may be present upstream of the cutting device and downstream of, and transversely displaced in relation to, the adjacent parallel conveyors hereinbefore described. The transverse displacement is preferably less than the width of one conveyor and conveniently 25% to 75% of the width. This makes it possible to record the weight for less length of material.

The means for causing the material to move transversely relative to the longitudinal direction of movement may be a conveyor adapted to travel longitudinally and also adapted to move transversely relative to the longitudinal direction of movement. The conveyor adapted to move transversely may conveniently be provided by a single endless conveyor belt capable of travelling longitudinally but also provided with means to move transversely in either direction, which may be actuated by a step-motor.

When movable, the cutting device is adapted to move transversely in either direction relative to the longitudinal movement of the fish or meat material on the conveyors. Although any kind of cutting device may be used, for example, jet cutting, a circular saw is preferred.

The movement of the means for causing the material to move transversely relative to the longitudinal direction of movement and of the cutting device may be achieved by a step motor which causes the part to move in either direction transversely before stopping in the appropriate position so that the meat or fish material is cut at the correct point by the cutting device.

The present invention also provides a process for the automatic cutting of meat or fish material by a fixed or movable cutting device to produce portions of a predetermined weight and length which comprises placing a meat or fish material onto the infeed end of at least two adjacent parallel conveyors travelling in the same direction substantially at the same speed so that the material lies partly on at least two conveyors, at least part of each conveyor being adapted to form the load-bearing platform of a weighing machine, the cutting device being positioned downstream of the weighing machines, the weighing machines record the weight of the material advancing on the load-bearing platforms, the recorded weight measurement is fed to a computer which is preprogrammed for at least one product factor defining a specified weight for a specified length and which calculates, from the recorded weight measurement, a weight factor defining a specified weight for a specified length of material, compares the actual weight factor calculated with the preprogrammed product factor and then actuates either the cutting device, when movable, to move transversely to the direction of movement of the conveyor or, when the cutting device is fixed, a means positioned between the weighing machines and the cutting device to cause the material to move transversely relative to the longitudinal direction of movement of the parallel conveyors, the direction and distance of the transverse movement of the cutting device or the means for causing the material to move transversely being controlled by the comparison of the actual weight factor calculated with the preprogrammed product factor, after which the material is cut by the cutting device in a direction parallel to the longitudinal direction of movement of the parallel conveyors.

The computer is preferably preprogrammed for more than one product factor and afterwards, the cut pieces may be graded by length by a means actuated by the computer.

The meat or fish material is conveniently placed on the apparatus manually so that the desired approximate weight of that part of the material which will form the portion having a predetermined weight lies substantially on the parallel conveyors adapted to form the load-bearing platforms of the weighing machines, conveniently by ensuring that the material contacts a fixed guide fitted in the appropriate position

above the conveyors.

The present invention is applicable to meat and fish materials of all sizes and shapes, for example cod or salmon. The invention is particularly suitable for cutting cod tails having a weight between about 50 g to 175 g, but is also applicable for cutting fillets weighing up to 700 g.

The present invention will now be illustrated by way of example with reference to the accompanying drawing in which Figure 1 represents a diagrammatic top plan view of an apparatus having five parallel weighing machines and Figure 2 represents a perspective view of the same apparatus.

Referring to the drawings, the apparatus comprises an infeed conveyor 10 on which rests the back piece of a pretrimmed fillet of cod 11, parallel endless belts 12,13,14,15,16 and 17 of which each of belts 12,13,14,15, 16 forms the load-bearing platform of a weighing machine respectively. Belt 12 is 100 mm wide and belts 13,14,15 and 16 are 50 mm wide. There is a gap of 10 mm between each belt. Downstream of the weighing machines is a conveyor 18 and downstream of conveyor 18 are cutting knives 19,20 and 21 positioned by step-motors 22,23 and 24 respectively. Downstream of cutting knives 20 and 21 are chunk knives 25,26,27 and 28 activated by step-motor 29. Downstream of the chunk knives is a conveyor 30 and an accelerating conveyor belt 31 provided with pushers 32,33,34 and 35 activated by a computer (not shown) and below each of which is a container 36,37,38 and 39 respectively and at the downstream end of the belt 31 is a further container 40.

In operation, the back pieces of the pretrimmed fillets of cod 11 are placed manually on infeed conveyor belt 10 and positioned so that one end contacts an adjustable guide bar (not shown) located above the edge of the infeed conveyor belt 10 at its left hand side relative to its direction of motion indicated by the arrow. The back pieces pass in the direction of the arrow towards the adjacent parallel belts. The back pieces advance over the load-bearing platforms of the endless belts and the weights of that part of the back piece on each belt are recorded and these weights, together with the lengths of the back piece lying on each belt, are fed to a computer (not shown) which calculates the weight factor for each belt i.e. the weight/length. The computer is preprogrammed for four product factors and by comparing the actual obtained weight factors along the back piece with the preprogrammed product factors, if any combination of weight factors matches one of the preprogrammed product factors, the computer calculates the position where the cutting is required and actuates at least one of the step motors 22,23 or 24 to cause the appropriate cutting knife 19,20 or 21 to move transversely to the longitudinal direction of movement of the back piece until the knife is in the appropriate position for cutting the back piece advancing on conveyor belt 18. Once the back piece has been cut, the desired cut product advances along the conveyor 30 and the accelerating conveyor 31 where a further signal from the computer actuates the appropriate pusher 32,33,34 or 35 to close so causing the cut fillet to fall into the appropriate container 36,37,38. 39 or 40.

As a specific example, the computer was preprogrammed for four different product factors as follows :

Product weight		Product length	Product factor	
150 g	10 g	140-150 mm	1.06897	0.06897
120 g	10 g	125-135 mm	0.96154	0.07692
88 g	2 g	100-130 mm	0.77391	0.01739
80 g	10 g	90-110 mm	0.85	0.1

For example if the length of the back piece of the cod fillet is 300 mm it is possible to produce two 150 gram loins if the product factor is high enough. If the product factor is low, it is possible to cut three smaller pieces e.g. each weighing 80 g. In addition, it is possible to cut combinations of larger or smaller loins in accordance with the obtained weight factors along the fillet of cod.

If the obtained weight factors do not match any of the preprogrammed product factors, the cutting knives 19,20 and 21 are not actuated and, in this case, the chunk knives 25,26,27 and 28 are actuated by the computer via the step motor 29 to cut the back piece into chunks which are collected either in a container or on a conveyor belt for transport to the freezer.

Claims

1. An apparatus for the automatic cutting of meat or fish material to produce portions of a predetermined weight and length, comprising at least two adjacent parallel conveyors suitable for transporting a meat or fish material lying partly on each conveyor, at least two adjacent parallel weighing machines, a computer and a fixed or movable cutting device positioned downstream of the weighing machines characterised in that the computer is preprogrammed for at least one product factor defining a specified weight for a specified length, the parallel conveyors are adapted to travel in the same direction at substantially the same speed and that at least part of each of the parallel conveyors is adapted to form the load-bearing platform of one of the weighing machines, each weighing machine being adapted to weigh the material lying on the load-bearing platform and to feed the recorded weight to the computer which is adapted to calculate a weight factor defining a specified weight for a specified length of material, the cutting device when movable being adapted to move transversely to the direction of movement of the conveyors, and when fixed there being provided means, positioned between the weighing machines and the cutting device, for causing the material to move transversely relative to the longitudinal direction of movement, the direction and distance of the transverse movement of the cutting device or the means for causing the material to move transversely being controlled by a comparison of the actual weight factors calculated with the preprogrammed product factors, the cutting device being adapted to cut the material parallel to the longitudinal direction of movement of the conveyors.

2. An apparatus according to claim 1 characterised in that the parallel conveyors comprise endless belts each of which is fixed to a weighing machine via the axles of the rollers.

3. An apparatus according to claim 1 characterised in that the parallel conveyors are separated from each other by a distance from 5 to 20 mm.

4. An apparatus according to claim 1 characterised in that the weighing machines are of the type consisting of continuously working scales based on load cells.

5. An apparatus according to claim 1 characterised in that the number of parallel weighing machines is from 4 to 6.

6. An apparatus according to claim 1 characterised in that the means for causing the material to move transversely relative to the longitudinal direction of movement is a conveyor adapted to travel longitudinally and also adapted to move transversely relative to the longitudinal direction of movement.

7. An apparatus according to claim 1 characterised in that it comprises means for grading the cut pieces by length.

8. An apparatus according to claim 1 characterised in that a second set of adjacent parallel conveyors adapted to form the load-bearing platforms of weighing machines is present upstream of the cutting device and downstream of, and transversely displaced in relation to, the adjacent parallel conveyors defined in claim 1.

9. A process for the automatic cutting of meat or fish material by a fixed or movable cutting device to produce portions of a predetermined weight and length which comprises placing a meat or fish material onto the infeed end of at least two adjacent parallel conveyors travelling in the same direction substantially at the same speed so that the material lies partly on at least two conveyors, at least part of each conveyor being adapted to form the load-bearing platform of a weighing machine the cutting device being positioned downstream of the weighing machines, the weighing machines record the weight of the material advancing on the load-bearing platforms, the recorded weight measurement is fed to a computer which is preprogrammed for at least one product factor defining a specific weight for a specified length of material, compares the actual weight factor calculated with the preprogrammed product factor, and then actuates either the cutting device, when movable, to move transversely to the direction of movement of the conveyor or, when the cutting device is fixed, a means positioned between the weighing machines and the cutting device to cause the material to move transversely relative to the longitudinal direction of movement of the parallel conveyors, the direction and distance of the transverse movement of the cutting device or the means for causing the material to move transversely being controlled by the comparison of the actual weight factor calculated with the preprogrammed product factor, after which the material is cut by the cutting device in a direction parallel to the longitudinal direction of movement of the parallel conveyor.

10. A process according to claim 8 characterised in that afterwards the cut pieces are graded by length.

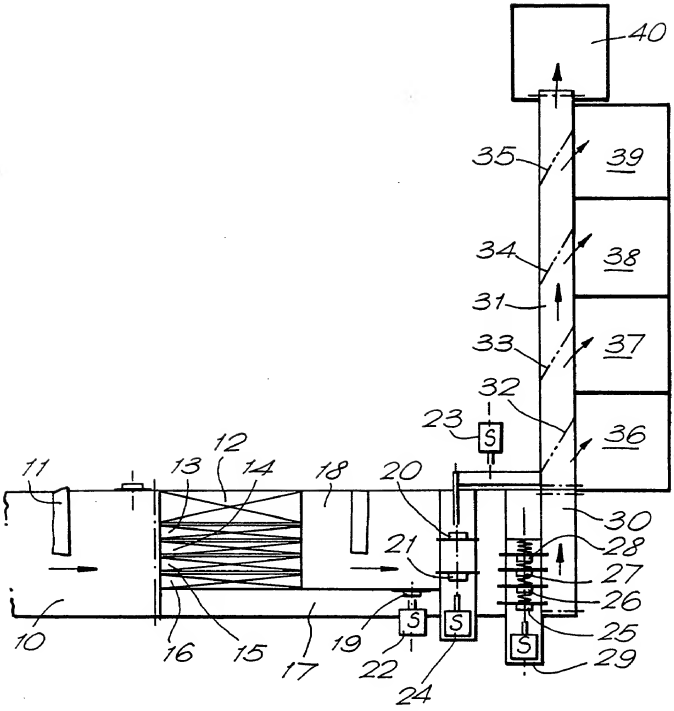


FIG. 1.

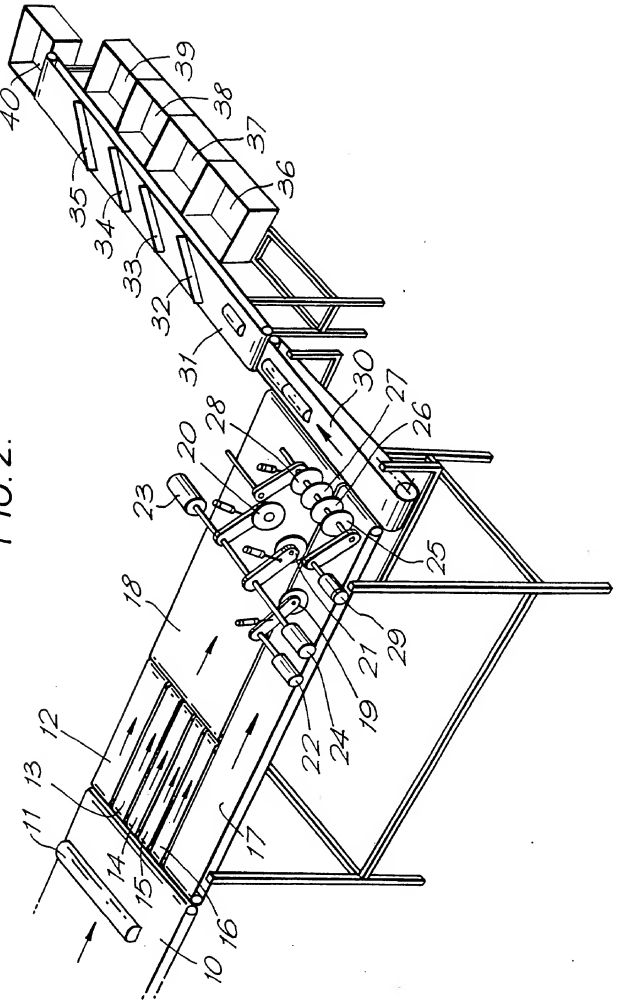


FIG. 2.

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 87 10 6205

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
A	GB-A-2 149 650 (WHITEHOUSE) * Whole document *	1,9	B 26 D 7/30
A	DE-A-1 432 518 (HARRINGTON)		
A	US-A-4 557 019 (VAN DEVANTER)		
A	FR-A-2 572 004 (HERVE-SIPEC S.A.)		
D,T	EP-A-0 235 322 (FRISCO-FINDUS)		

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

B 26 D
A 22 C
A 22 B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	02-12-1987	BERGHMANS H.F.

CATEGORY OF CITED DOCUMENTS

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